Supportive Care in Cancer (2019) 27:705–713
https://doi.org/10.1007/s00520-018-4530-5

ORIGINAL ARTICLE

The impact of social-emotional context in chronic cancer pain: patient-caregiver reverberations

Social-emotional context in chronic cancer pain

Martina De Laurentis[1] · **Botto Rossana**[1] · **Bovero Andrea**[1] · **Torta Riccardo**[1] · **Ieraci Valentina**[1]

Received: 20 September 2017 / Accepted: 23 October 2018 / Published online: 31 October 2018

Abstract

Purpose Pain is a multifactorial and subjective experience. Psychological and social factors can modulate it. This study analyzed whether and how prolonged cancer pain is related to the social-relational environment's characteristics. Specifically, we investigated whether the caregiver's emotional support, his/her compassion ability or, on the contrary, his/her personal distress, associates with the patient's pain level.

Methods The sample consisted of 38 cancer patients suffering from pain and 38 family caregivers. The patients completed the McGill Pain Questionnaire (MPQ), the Balanced Emotional Empathy Scale (BEES) referred to caregiver, and an interview concerning the patient's perception of the caregiver's compassion level. Caregivers completed the distress thermometer (DT), the BEES, and an interview assessment of their compassion level.

Results Caregiver's distress level correlated with patient's pain intensity ($r = .389$; $p = .028$). Exploratory linear regression confirmed this association ($R^2 = .151$; $F\ (1,\ 30) = 5.33$; $p = .028$; $\beta = 0.389$). The number of problems reported by caregivers correlated with the patients' pain level ($r = .375$; $p = .020$), which was verified in a regression analysis ($R^2 = .140$; $F\ (1,\ 36) = 5.88$; $p = .020$; $\beta = 0.375$). In particular, the caregiver's amount of emotional problems was related to patient's pain level ($r = .427$; $p = .007$); this result was reaffirmed in a regression ($R^2 = .182$; $F\ (1,\ 36) = 8.03$; $p = .007$; $\beta = 0.427$).

Conclusions Our results show an association between social suffering, as indicated by the caregiver's emotional distress and the patient's physical pain. The results also highlight high distress levels and emotional problems among caregivers. The work emphasizes the need of a bio-psychosocial approach in managing cancer pain, along with the necessity to find effective interventions to fight emotional distress in family caregivers. The recovery of the caregivers' emotional resources could have beneficial implications on the patients' pain.

Keywords Cancer pain · Emotional support · Empathy · Compassion · Personal distress · Caregiver · Bio-psychosocial model

Introduction

Cancer patients often experience pain. According to the National Institutes of Health, between 14 and 100% of the patients feel pain [1]. Higher prevalence rates are reported among patients under active treatments (50–70%) and among patients in advanced stage of disease (60–90%) [2]. The experience of pain is complex and multifactorial; it cannot be reduced to the perception of sensory qualities of the nociceptive stimulus. Psychological factors modulate pain and make it a strictly subjective event. Some of the most important cognitive and emotional aspects affecting pain experience are stress level, anxiety, and depression [3, 4]; emotion awareness and expression [5]; evaluative processes, beliefs, and coping strategies [6–8]; and expectancy and motivation [9, 10]. The social and relational environment influence pain too, whereby important factors are social connection and support. *Social support* is defined as the degree of perceived satisfaction with social relationships [11] or as the resources, effective or perceived as being available, from others in the social network [12]. It is categorized into emotional, tangible, informal, and companionship support. Emotional support, specifically, is the

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✉ Martina De Laurentis
martina.delaurentis@edu.unito.it

[1] Clinical and Oncological Psychology Unit, Department of Neuroscience, University of Turin, Corso Bramante 88/100, 10126 Turin, TO, Italy

offering of empathy, concern, affection, love, trust, acceptance, encouragement, and caring [13]. Social support has both direct effects on pain and health outcomes, as well as indirect effects that protect individuals from the negative influence of stress-related biological processes [e.g., 14, 15]. For example, a randomized factorial mixed design study by Montoya and colleagues (2004) showed that individuals with chronic pain report less severe pain and show less activation of the central nervous system under painful conditions when they are in the presence of their significant other [16]. A cross-sectional study reports that chronic pain patients receiving higher levels of social support not only exhibit decreased depressive symptomatology, but also pain intensity, which, in turn, decreases functional impairment and increases functional status [12]. Conversely, the lack of social connection and caring may feel "painful" [17, 18]. Recent evidence suggests that "social pain"—the painful feelings following events of social disconnection such as rejection, isolation, social loss, or lack of support—and physical pain are processed, in part, by the same neural circuitry [18]. As a consequence of this physiological similarity, these two types of pain experience can influence each other: experimental and longitudinal studies have demonstrated that feelings of social pain can increase physical pain sensitivity [19, 20], while physical pain can exacerbate feelings of social rejection, even without actual experiences of exclusion [21]. On the other side, providing a suffering person with social support can be a very demanding task. Family caregivers assume increasingly more responsibility and frequently take on burdens for which they are not prepared. As a consequence, they often develop physical and emotional illnesses [22]. The detrimental physical effects, though, are generally less intensive than the psychological ones [23]. Emotionally, cancer patient caregivers face symptoms of anger, depression, mood disturbances, and anxiety [22, 24, 25]. Besides, caregivers often experience empathy through which they share pain and suffering with the patient. Evidence from experimental studies shows that empathizing with somebody else's pain activates brain regions involved in the first-hand experience of pain [26] and can also increase pain sensitivity in the observer [27]. The empathic involvement with another person's suffering evokes primarily two kinds of responses in the observer: *compassion*, which is also referred to as sympathy, or *empathic distress*, also called personal distress [28, 29]. *Compassion* is conceived as a feeling of concern for another person's suffering, which is associated with approach, prosocial motivation, and behavior. *Empathic distress*, on the other hand, refers to a self-focused, strong aversive affective reaction to the suffering of another, accompanied by the desire to withdraw from the situation in order to protect oneself from excessive negative feelings, thereby decreasing the likelihood of prosocial behavior [29]. Thus, individuals who experience high levels of empathy and involvement towards the patient's pain are vulnerable to the development of psychological symptoms such as distress, fatigue, and even an increased pain sensitivity. Empathic distress, moreover, affects caregivers' emotional resources to support and connect with the patient.

To build upon previous work, the primary purpose of this study was to assess the contribution of the social-emotional dimension on prolonged pain in cancer patients. More specifically, we investigated whether and how the caregiver's emotional support, effective (the caregiver's actual compassion ability or, on the contrary, his/her personal distress level) or perceived (the patient's perception of emphatic concern received by the caregiver), was related to the patient's pain level. Additionally, this study investigated potential factors associated with "caregiver's burden" among the respective family caregivers.

Methods

Sample

Participants were recruited between October 2016 and December 2016 at *Clinical and Oncological Psychology* and *Medical Oncology* Units of San Giovanni Hospital "Molinette" in Turin. Each participant was tested with the Mini-Mental State Examination (MMSE) to assess his/her cognitive capacity to provide informed consent and to complete the questionnaires. The inclusion criteria were (1) being diagnosed with cancer; (2) age > 18 years; (3) compliance with the basic criterion of chronic pain definition, which, according to the International Association for the Study of Pain (IASP) Task Force for the Classification of Chronic Pain in ICD-11, is "Persistent or recurrent pain lasting longer than 3 months" [30]; (4) being accompanied by the main family caregiver, who was also willing to participate in the research. Exclusion criteria were a score lower or equal to 19 on the MMSE and the presence of psychotic mental disorders.

Procedure

The researchers approached potential participants in the waiting rooms of the aforementioned healthcare units, with an initial screening question: "Are you experiencing pain daily or almost daily for at least three months?". Respondents who answered "yes" were considered compliant with the basic criterion of chronic pain and were consequently included in the study. Patients and caregivers were asked to read and complete two different test batteries independently. They were offered the possibility to fill out the tests in loco or at home. Participants were encouraged to ask questions in case of doubt about any of the items or otherwise. Finally, participants were briefed that all gathered data will be used for research purposes only and will be kept anonymous. Participants provided written informed consent following the protocols admitted by Ethics Committee of the City of Health and Science University Hospital of Turin that approved this study. We asked a total of 85 cancer patients to participate; 35 were deemed ineligible for the study and were therefore excluded. Specifically, 18 cancer patients did not pass the screening question, i.e., reported no chronic pain; 12 patients did not have a caregiver; 5 patients had a caregiver who refused participation. Therefore, 50 patients with a primary caregiver were recruited. During the study, additional 5 dyads agreed to participate by completing the questionnaires at home but did not return the tests, 5 dyads withdrew their participation from the study, and another 2 patients passed away before returning the questionnaires. The final sample consisted of 38 dyads (76 participants).

Screening tools

All participants completed a sheet collecting *socio-demographic information* (sex, age, marital status, children, educational level, occupational status, primary caregiver, eventual psychological therapy). Patients also completed a sheet collecting *clinical information* (tumor site, stage of the disease, treatment phase, type of therapy, presence of second tumor site, eventual psychopharmacological treatment).

The caregivers completed three tests. The *Distress Thermometer* (DT) is a self-report measure of psychological distress [31]. Responders are asked to rate their distress level using a thermometer visual analogue scale with scores ranging from 0 (“no distress”) to 10 (“extreme distress”). The cut-off score is 4. The thermometer is accompanied by a problem list, which asks subjects to identify any of 34 issues (grouped into five categories: practical, relational, emotional, spiritual, and physical concerns) that have been a source of their general distress level. The *Balanced Emotional Empathy Scale* (BEES) [32] is a 30-item instrument scored on a 9-point Likert scale, which evaluates the level of affective empathy, i.e., the extent to which the respondent can emphatically share others’ emotions (e.g., feel others’ suffering or take pleasure in their happiness). Finally, to evaluate the caregivers’ actual ability to experience compassion towards the patient, a brief interview of 10 questions on a 9-point Likert scale was conducted. The interview was based on the questions concerning relational empathy of the *Barrett-Lennard Relationship Inventory* (BLRI)—*Empathy Understanding subscale* [33]. The patients completed three additional tests. The *McGill Pain Questionnaire* (MPQ) is a multidimensional scale designed to measure different aspects of pain experience and pain intensity in adults suffering from chronic painful conditions with different etiology [34]. The MPQ contains 78 pain descriptor items categorized into 20 subclasses that fall into four major subscales: sensory, affective, evaluative, and miscellaneous [35]. The patients also completed the BEES in order to assess the perceived empathy level of the caregiver. In this case, the participants were instructed to read the sentences with reference to their caregiver and not to themselves. Finally, to investigate the patient’s perception of the caregiver’s compassion level, the same interview based on the BLRI was used. Similarly, the patients were told that the questions were referred to their caregiver and, in answering them, they should think about their actual relationship with him/her.

Statistical analysis

Statistical analysis was executed using SPSS Statistics version 23.0 (IBM Corp. Armonk, NY, USA). Descriptive statistics including means, standard deviations, and frequencies were used to describe the sample’s socio-demographic and clinical characteristics. To assess variables distributions, measures of skewness and kurtosis were used. For the multivariate analysis, we used bivariate Pearson’s correlations, exploratory linear regressions, and means comparisons through independent samples T test. None of the test assumptions were found violated. The tests were two-sided and a p value of less than .05 was considered statistically significant.

Results

Descriptive statistics

The 38 dyads were composed by the patients and their respective primary family caregivers. As shown in Table 1, cancer patients (65% female, $n = 25$) were at an average age of 58.5 years ($SD = 13.4$; range 30–78); male and female caregivers were balanced and at an average age of 54.4 years ($SD = 14.8$; range 20–79). Seventy-eight percent of the patients ($n = 30$) and 63% of the caregivers ($n = 24$) were married. The majority of the patients (65%, $n = 25$) reported their spouse as their “primary caregiver”; caregivers reported their spouse as “caregiver” (44%, $n = 17$) nearly as frequently as they reported “none” (34%, $n = 13$). The majority of both patients (65%, $n = 25$) and caregivers (84%, $n = 32$) reported that they were not receiving psychological therapy. Regarding illness, the majority of patients was under active treatment (89%, $n = 34$) of chemotherapy (84%, $n = 32$). As presented in Table 2, 60% of the patients ($n = 23$) reported a mild pain level, 29% ($n = 11$) reported a moderate pain level, and 11% ($n = 4$) a severe pain level. The mean score of total pain in the patients’ group was 21.87 ($SD = 21.12$), corresponding to 28% of the maximum score of the MPQ. This value is in line with the normative mean scores across chronic painful conditions that range from 24 to 50% of the maximum score of the MPQ [35]. Hence, cancer pain falls within the category of chronic pain. Regarding the patients’ perception of the caregiver’s empathy, almost all patients (97%, $n = 37$) reported a

Table 1 Patients' and caregivers' socio-demographic characteristics and patients' clinical characteristics

	n (%)	M (SD)
Patients' socio-demographic characteristics		
Sex		
Male	13 (35)	
Female	25 (65)	
Age		58.5 ± 13.4
Educational level (years)		11.5 ± 3.7
Marital status		
Unmarried	3 (7.9)	
Divorced	1 (2.6)	
Partner cohabitant	2 (5.3)	
Married	30 (78.9)	
Widow	2 (5.3)	
Children		
Yes	31 (81.6)	
No	7 (18.4)	
Occupational status		
Employed	11 (28.9)	
Retired	15 (39.5)	
Student	0	
Unemployed	4 (10.5)	
Housewife	4 (10.5)	
Occasional worker	3 (7.9)	
Caregiver		
None	0	
Spouse	25 (65.8)	
Children	3 (7.9)	
Friend	1 (2.6)	
Partner	4 (10.5)	
Other relative	4 (10.5)	
Psychological therapy		
Yes	13 (34.2)	
No	25 (65.8)	
Caregivers' socio-demographic characteristics		
Sex		
Male	19 (50)	
Female	19 (50)	
Age		54.43+/14.84
Educational level (years)		12.6+/3.99
Marital status		
Unmarried	9 (23.7)	
Divorced	1 (2.6)	
Partner cohabitant	2 (5.3)	
Married	24 (63.2)	
Widow	1 (2.6)	
Children		
Yes	25 (65.8)	
No	13 (34.2)	
Occupational status		
Employed	16 (42.1)	
Retired	14 (36.8)	
Student	2 (5.3)	
Unemployed	3 (7.9)	
Housewife	1 (2.6)	
Occasional worker	0	
Caregiver		
None	13 (34.2)	
Spouse	17 (44.7)	
Children	5 (13.2)	
Friend	0	
Partner	2 (5.3)	
Other relative	1 (2.6)	
Psychological therapy		
Yes	2 (5.3)	
No	32 (84.2)	
Patients' clinical characteristics		
Tumor site		
Breast	14 (31.8)	
Bones	1 (2.3)	
Dermatologic	1 (2.3)	
Gynecologic	1 (2.3)	
Gastric	9 (20.5)	
Genitourinary	1 (2.3)	
Head/neck	7 (16)	
Hodgkin's	1 (2.3)	
Lung	6 (13.6)	
Presence of second tumor site		
Yes	6 (15.8)	
No	32 (84.2)	
Stage of the disease		
Under active treatment	34 (89)	
In remission	4 (11)	
Treatment phase		
Waiting for therapy	2 (5.3)	
Active treatment	34 (89.5)	
Follow-up	1 (2.6)	
Type of therapy		
Chemotherapy	32 (84.2)	
Radiotherapy	2 (5.3)	
Pharmacotherapy	3 (7.9)	
Psychopharmacological treatment	10 (26.3)	

n cumulative absolute frequencies, % percentage frequencies, *M* means, *SD* standard deviations

Table 2 Descriptive statistics of patients' pain and patients' perception of caregiver's empathy and compassion; caregivers' distress, empathy and compassion

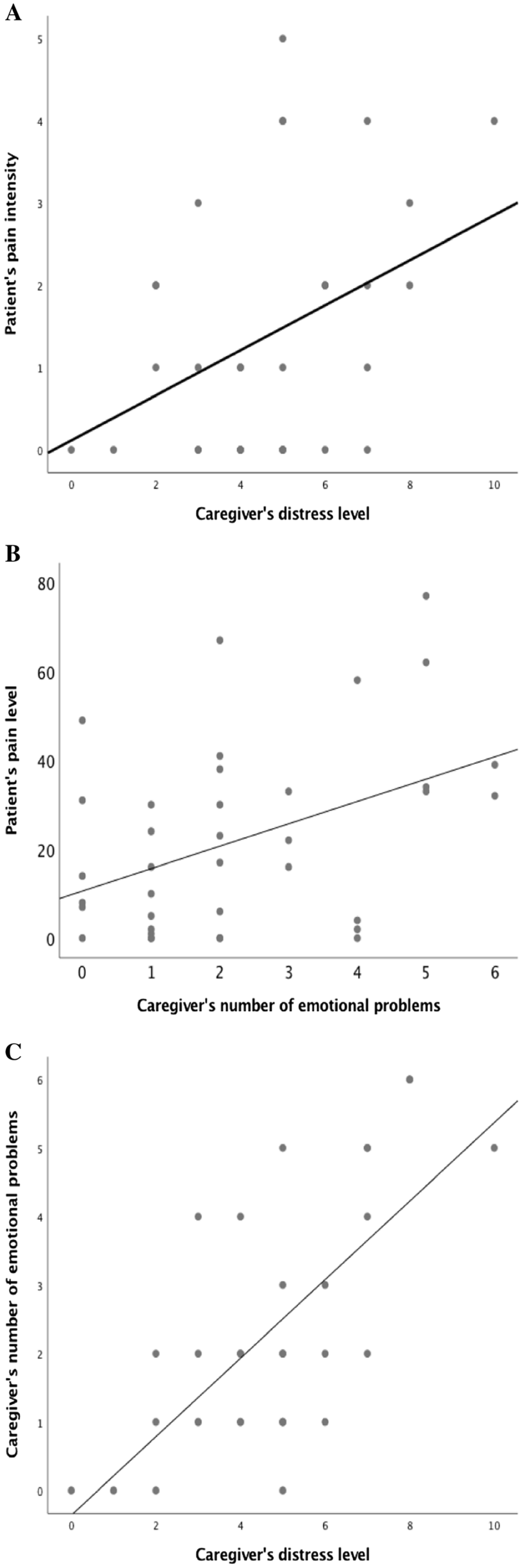
	n (%)	M (SD)
Patients' pain		
Total pain		21.87 ± 21.12
Pain subscales		
Sensory		12.68 ± 11.87
Affective		3.45 ± 3.89
Evaluative		1.34 ± 1.59
Miscellaneous		4.39 ± 5.11
Level of pain		
Mild	23 (60.5)	7.7 ± 8.32
Moderate	11 (28.9)	35.45 ± 5.82
Severe	4 (10.5)	66 ± 8.2
Patients' perceived empathy		
Total perceived empathy		135.86 ± 13.18
Level of perceived empathy		
Low	0	
Medium	37 (97.4)	135.83 ± 3.97
High	1 (2.6)	149.92 ± 7.32
Patients' perceived compassion		
Total perceived compassion		55.53 ± 9.6
Level of perceived compassion		
Low	0	
Medium	17 (44.7)	50.24 ± 3.59
High	21 (55.3)	63.53± 4.98
Caregivers' distress		
Total distress		4.71 ± 2.18
Level of distress		
Mild	14 (36.8)	2.79 ± 1.25
Moderate	15 (39.5)	5.73 ± 0.88
Severe	9 (23.7)	8.67 ± 1.15
Reported problems		
In practical sphere	13 (34.2)	
In relational sphere	6 (15.8)	
In emotional sphere	32 (84.2)	
In spiritual sphere	3 (7.9)	
In physical sphere	30 (78.9)	
Emotional problems		
Depression	3 (7.9)	
Fears	11 (28.9)	
Irritability	12 (31.5)	
Sadness	17 (44.7)	
Worry	24 (63.2)	
Loss of interest in daily activities	8 (21.5)	
Caregivers' empathy		
Total empathy		145.28 ± 13.77
Level of empathy		
Low	0	
Medium	31 (81.6)	137.73 ± 4.17
High	7 (18.4)	159 ± 8.97
Caregivers' compassion		
Total compassion		53.78 ± 8.59
Level of compassion		
Low	0	
Medium	19 (50)	46.5 ± 4.34
High	19 (50)	60.68 ± 5.15

n cumulative absolute frequencies, % percentage frequencies, *M* means, *SD* standard deviations

medium empathy level of the caregiver, whereas half of the patients (45%, $n = 17$) reported a medium compassion level and the other half (55%, $n = 21$) a high compassion level. With regard to caregivers' characteristics, 39% of the caregivers ($n = 15$) had a moderate distress level, 37% of them ($n = 14$) a mild distress level, and 24% ($n = 9$) a severe one. In total, 63% of the caregivers had a distress level above the cut-off. The majority of the caregivers reported having problems in the emotional (84%, $n = 32$) and in the physical sphere (78%, $n = 30$). In particular, the most common emotional problems among caregivers were "worry" (63%, $n = 24$), "sadness" (45%, $n = 17$), "irritability" (31%, $n = 12$), and "fears" (29%, $n = 11$). Most caregivers indicated a medium empathy level (81%, $n = 31$), while half of the caregivers reported a medium compassion level (50%, $n = 19$) and the other half (50%, $n = 19$) a high compassion level.

Analysis of the associations between caregiver's emotional resources and patient's pain

An initial analysis did not show a significant association of empathy level (effective or perceived) and compassion level (effective or perceived) with patient's pain. Nevertheless, we observed a positive correlation between the caregiver's distress level and the patient's pain, which was subjectively reported in the evaluative subscale of the MPQ ($r = .389$; $p = .028$) (Fig. 1a). This subscale describes the overall subjective intensity of pain experience [34]. Moreover, the total amount of problems reported by the caregiver was positively associated with all subcategories of the patient's pain: total pain ($r = .375$; $p = .020$), sensory ($r = .340$; $p = .037$), affective ($r = .326$; $p = .46$), evaluative ($r = .386$; $p = .017$), and miscellaneous ($r = .389$; $p = .016$). Specifically, we observed a precise correlation between the caregiver's total quantity of emotional problems and the patient's pain level ($r = .427$; $p = .007$) (Fig. 1b); crucially, the total quantities of problems reported by the caregiver in the other domains (practical, relational, physical, and spiritual) were not correlated with patient's pain level. Exploratory simple linear regressions confirmed the



◀ **Fig. 1** Linear associations between **a** the caregiver's general distress level and the patient's pain intensity as observed the positive correlation ($r = .389$; $p = .028$) and subsequently in the regression ($R^2 = .151$; F (1, 30) = 5.33; $p = .028$; $\beta = 0.389$), **b** the caregiver's total quantity of emotional problems and the patient's pain level as revealed by the bivariate correlation ($r = .427$; $p = .007$) and reaffirmed by the linear regression ($R^2 = .182$; F (1, 36) = 8.03; $p = .007$; $\beta = 0.427$), and **c** the caregiver's general distress level and the total number of emotional problems experienced by him/her as showed by the bivariate correlation ($r = .687$; $p < .001$) and further established in the regression analysis ($R^2 = .472$; F (1, 30) = 26.87; $p < .001$; $\beta = 0.687$)

relationship between caregiver's emotional distress and patient's pain showing that the caregiver's general distress level was significantly associated with the patient's pain intensity ($R^2 = .151$; F (1,30) = 5.33; $p = .028$; $\beta = 0.389$). The patient's pain level was also linked to the caregiver's total number of problems ($R^2 = .140$; F (1, 36) = 5.88; $p = .020$; $\beta = .375$), and, in particular, to the caregiver's total amount of emotional problems ($R^2 = .182$; F (1, 36) = 8.03; $p = .007$; $\beta = 0.427$).

Analysis of the associations between caregiver's problems and distress level

To understand which factors were related to the caregivers' distress, we computed the correlations between caregiver's general distress level and number of problems reported in different domains (practical, relational, emotional, spiritual, and physical). Even though marginally significant associations were found between the number of relational problems and general distress level ($r = .336$; $p = .060$), and between the number of relational problems and the number of emotional problems ($r = .309$; $p = .059$), only the quantity of the caregiver's problems in the emotional sphere was significantly correlated with the general distress level experienced by him/her ($r = .687$; $p < .001$) (Fig. 1c). This relation was further established in a regression analysis ($R^2 = .472$; F (1, 30) = 26.87; $p < .001$; $\beta = 0.687$). Finally, analyzing emotional problems one by one, multiple single t tests revealed a significantly higher distress level when the problems "depression" ($\Delta mean = 3.56$; $t = -3.47$; $p = .002$), "fears" ($\Delta mean = 2.23$; $t = -3.01$; $p = .005$), "irritability" ($\Delta mean = 2.72$; $t = -3.89$; $p = .001$), "sadness" ($\Delta mean = 2.35$; $t = 3.57$; $p = .001$), and "loss of interest in daily activities" ($\Delta mean = 3.13$; $t = -4.36$; $p < .001$) were present compared to when these problems were not reported by caregivers.

Discussion

Our results show that the caregiver's distress level, mainly pertaining to his/her emotional problems, correlates positively with the patient's pain intensity. Personal distress is able to adversely influence the effective resources and the capacity of an individual to provide another suffering one with compassion and prosocial behaviors, and it is often linked to fatigue and relational withdrawal [28, 29]. As a result, the caregiver's personal distress can indirectly lead to a lack of (or a worsening of the quality of) the social-emotional connection and support of the patient and may in turn increase the patient's perception of isolation. Thus, these data provide evidence in favor of the physical/social pain overlap theory [17–21]. In fact, suffering in the patient's social sphere, as reflected by the emotional distress of caregiver in this study, is significantly correlated with the patient's physical pain level. Alleviating the suffering in the patient-caregiver relational environment could play an important role in the effective management of prolonged pain. First analyses, however, failed to find associations between the caregiver's effective or perceived empathy and compassion levels and the patient's pain level. A possible explanation for these results is that self-report inquiry of empathy and compassion have been affected by social desirability and acquiescence [36]. Literature on the subject indeed suggests that there are substantial problems with relying solely on self-report measures to estimate empathy. These are often convoluted by the individual's concerns with their own evaluations or those of others. In other words, the extent to which participants wish to be perceived in empathy-inducing contexts cannot be disentangled from how respondents actually feel in such settings on the basis of the self-reports [26, 36]. Furthermore, the assessment of empathy and compassion itself could make people feel "under accusation," as if one is not compassionate or empathic enough. Participants therefore tend to answer in, what they consider, the most "normal" way in order to not appear dissimilar from others. Moreover, acquiescence is a form of compliance, which is observed when individuals respond positively to all questions irrespective of the content. Together, these biases tend to cause average or higher scores without reflecting the actual empathy levels. This appears to be the case in our study as all empathy and compassion scores collected with self-reports were clustered in the middle to high ranges of the distribution. As a consequence, it is difficult to draw conclusions about the absence of such relationships and further investigations using alternative measures are required.

The description of the caregivers' condition in this sample was critical: more than half of the caregivers (63%) reported a distress level above the cut-off, which indicates the necessity of an intervention [31], and 84% of them reported at least one emotional problem. Furthermore, emotional problems were the main source of the caregivers' distress. In spite of this, the majority of caregivers (84%) reported that they were not receiving any psychological therapy.

These results are in line with previous literature highlighting that the role of the cancer patient caregiver satisfies all criteria for chronic stress and, as such, primarily impacts the caregiver's psychological well-being leading to the development of emotional symptoms like depression and anxiety [23, 25]. Moreover, existing literature points out that anxiety, tension, and depression are significantly higher among caregivers of cancer patients in pain than among caregivers of pain-free patients [37, 38]; previous work also shows that the patient's perceived pain plays an independent role in affecting the caregiver's emotional burden and distress [39]. These studies are in line with the detected positive associations between the patient's pain level and the caregiver's emotional distress.

Limitations

A limitation we already discussed was the difficulty of validly assessing empathy and compassion through self-report measures. Another issue was the experimental attrition our study suffered. The sample size was based on reviews studies [40–42], describing experiments that shared sample and design characteristics with our prospective study. Although the initial recruited sample was 50 dyads, we suffered an unforeseen participant dropout. A larger sample size would therefore yield more statistical power for assessing the presence of the hypothesized effects, which we will be opting for in future works. The exclusion of the socio-demographic and clinical characteristics from the analyses is another limit. Although this study design focused specifically on the assessment of selected social-emotional variables, we recognized that personal and medical characteristics have an important impact on cancer pain. A focused study analyzing also the contribution of these characteristics on chronic cancer pain may be interesting in order to build a fuller picture of the phenomenon. We decided to leave aside the medical features from the analysis because the sample was highly homogeneous in regard to patients' clinical characteristics; therefore, we assumed them as stable characteristics of the group. Regarding the socio-demographic aspects, we investigated the associations between age and pain level and between sex and pain level, but both resulted not significant. Therefore, we decided not to include these variables as covariate in the following regressions. The cross-sectional design is another weakness because it does not allow for causal inference about the relationships between the studied variables but provides a descriptive account of the cancer patient-primary caregiver dyad. Due to the cross-sectional design, we cannot exclude that patient's pain level may also be a factor impacting on caregiver's distress level as an alternative explanation. These preliminary results thus call for replication using more complex study designs. Longitudinal studies, for instance, taking multiple measures over an extended period of time, can be a useful tool for determining cause-effect relationships between the studied variables. Finally, by omitting patients without pain, we may have left out patients for whom the family caregivers' support has had the largest impact, i.e., we cannot assess the potential contributions of very strong emotional support to the absence of pain in cancer patients. Moreover, having excluded patients who were not accompanied by their main family caregiver, this study may have excluded patients for whom caregiver support is least effective with regard to the amelioration of pain. A replication including cancer patients without chronic pain and patients without primary caregiver would allow us to better understand how the different social-emotional environments surrounding patients affect pain experience.

Conclusions

This study shows that the cancer patient's physical pain is connected to his/her interpersonal environment, as higher patient pain levels were found associated with poorer caregiver emotional well-being, and thereby supports the necessity of a bio-psychosocial approach to the treatment of prolonged cancer pain. In several healthcare settings, pain management still tends to take a biomedical approach, which often concentrates on the organic origin of pain, regarding it mostly as a potential diagnostic tool and therefore undervaluing its psychosocial influences [21]. Furthermore, several investigations have concluded that the bio-psychosocial model is being adopted only partially, with a focus on cognitive and behavioral factors but without a consideration of the social dimension of pain [e.g., 43]. The present work shows that the relational reality is clearly connected to the prolonged pain experience by cancer patients: the caregiver's emotional distress alone explains 18% of the variance in the overall patient's perceived pain level.

The results also highlight the necessity of developing effective interventions to support the family caregivers. The constant contact with suffering and pain exposes caregivers to emotional exhaustion and personal distress. Identifying those caregivers who manifest greater emotional distress and help them to improve their condition will be, firstly, beneficial for their psychological health and, secondly, will improve the patient's painful experience by restoring the emotional resources that can be dedicated to the patient's support. Some interesting studies [e.g., 28] describe a type of ability training named *Compassion Training* that could be useful in this context. It has been demonstrated that *Compassion Training*, by cultivating feelings of warmth and prosocial motivation, increases positive affective experiences, even in response to others' suffering, and it is associated with stronger activations in brain regions previously implicated in positive valuation, as well as love and affiliation [44, 45]. Future research could evaluate whether engaging caregivers suffering from emotional distress in a brief training program would impact positively the caregivers' psychological well-being and whether and how the recovery of emotional resources would in turn benefit the patients' pain.

Compliance with ethical standards

Conflicts of interest The authors declare that they have no conflict of interest.

Ethical approval All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent Informed consent was obtained from all individual participants included in the study.

References

1. National Institutes of Health State-of-the-Science Panel (2003) National Institutes of Health state-of-the-science conference statement: symptom management in cancer: pain, depression, and fatigue, July 15–17, 2002. J Natl Cancer Inst 95(15):1110–1117
2. Keefe FJ, Abernethy AP, Campbell CL (2005) Psychological approaches to understanding and treating disease-related pain. Annu Rev Psychol 56:601–630
3. Hannibal KE, Bishop MD (2014) Chronic stress, cortisol dysfunction, and pain: a psychoneuroendocrine rationale for stress management in pain rehabilitation. Phys Ther 94(12):1816–1825
4. Torta RG, Ieraci V (2013) Depressive disorders and pain: a joint model of diagnosis and treatment. J Pain Relief S 2:2167–0846
5. Lumley MA, Cohen JL, Borszcz GS, Cano A, Radcliffe AM, Porter LS, Schubiner H, Keefe FJ (2011) Pain and emotion: a biopsychosocial review of recent research. J Clin Psychol 67(9): 942–968
6. Gatchel RJ, Peng YB, Peters ML, Fuchs PN, Turk DC (2007) The biopsychosocial approach to chronic pain: scientific advances and future directions. Psychol Bull 133(4):581–624
7. Linton SJ, Shaw WS (2011) Impact of psychological factors in the experience of pain. Phys Ther 91(5):700–711
8. Sturgeon JA, Zautra AJ (2013) Psychological resilience, pain catastrophizing, and positive emotions: perspectives on comprehensive modeling of individual pain adaptation. Curr Pain Headache Rep 17(3):1–9
9. Koyama T, McHaffie JG, Laurienti PJ, Coghill RC (2005) The subjective experience of pain: where expectations become reality. Proc Natl Acad Sci U S A 102(36):12950–12955
10. Colloca L, Grillon C (2014) Understanding placebo and nocebo responses for pain management. Curr Pain Headache Rep 18(6): 1–7
11. Lutgendorf, S. K., De Geest, K., Bender, D., Ahmed, A., Goodheart, M. J., Dahmoush, L., ... & Thaker, P. H. (2012) Social influences on clinical outcomes of patients with ovarian cancer. J Clin Oncol 30(23):2885–2890
12. López-Martínez AE, Esteve-Zarazaga R, Ramírez-Maestre C (2008) Perceived social support and coping responses are independent variables explaining pain adjustment among chronic pain patients. J Pain 9(4):373–379
13. Taylor SE (2011) Social support: a review. The Oxford handbook of health psychology. OUP, USA
14. Uchino BN (2006) Social support and health: a review of physiological processes potentially underlying links to disease outcomes. J Behav Med 29(4):377–387
15. Cole SW, Hawkley LC, Arevalo JM, Sung CY, Rose RM, Cacioppo JT (2007) Social regulation of gene expression in human leukocytes. Genome Biol 8(9):R189

16. Montoya P, Larbig W, Braun C, Preissl H, Birbaumer N (2004) Influence of social support and emotional context on pain processing and magnetic brain responses in fibromyalgia. Arthritis Rheum 50(12):4035–4044
17. Eisenberger NI (2012) The pain of social disconnection: examining the shared neural underpinnings of physical and social pain. Nat Rev Neurosci 13(6):421–434
18. Eisenberger NI, Lieberman MD, Williams KD (2003) Does rejection hurt? An fMRI study of social exclusion. Science 302(5643): 290–292
19. Eisenberger NI, Jarcho JM, Lieberman MD, Naliboff BD (2006) An experimental study of shared sensitivity to physical pain and social rejection. Pain 126(1):132–138
20. Bernstein MJ, Claypool HM (2012) Social exclusion and pain sensitivity: why exclusion sometimes hurts and sometimes numbs. Personal Soc Psychol Bull 38(2):185–196
21. Riva P, Wirth JH, Williams KD (2011) The consequences of pain: the social and physical pain overlap on psychological responses. Eur J Soc Psychol 41(6):681–687
22. Blum K, Sherman DW (2010) Understanding the experience of caregivers: a focus on transitions. Semin Oncol Nurs 26(4):243–258
23. Schulz R, Sherwood PR (2008) Physical and mental health effects of family caregiving. J Soc Work Educ 44(sup3):105–113
24. Stenberg U, Ruland CM, Miaskowski C (2010) Review of the literature on the effects of caring for a patient with cancer. Psycho-Oncology 19(10):1013–1025
25. Girgis A, Lambert S, Johnson C, Waller A, Currow D (2012) Physical, psychosocial, relationship, and economic burden of caring for people with cancer: a review. J Oncol Pract 9(4):197–202
26. Singer T, Lamm C (2009) The social neuroscience of empathy. Ann N Y Acad Sci 1156(1):81–96
27. Loggia ML, Mogil JS, Bushnell MC (2008) Empathy hurts: compassion for another increases both sensory and affective components of pain perception. Pain 136(1):168–176
28. Singer T, Klimecki OM (2014) Empathy and compassion. Curr Biol 24(18):R875–R878
29. Eisenberg N, Eggum ND (2009) Empathic responding: sympathy and personal distress. In The social neuroscience of empathy 6:71–83
30. Treede RD, Rief W, Barke A, Aziz Q, Bennett MI, Benoliel R et al (2015) A classification of chronic pain for ICD-11. Pain 156(6): 1003
31. Jacobsen PB, Donovan KA, Trask PC, Fleishman SB, Zabora J, Baker F, Holland JC (2005) Screening for psychologic distress in ambulatory cancer patients. Cancer 103(7):1494–1502
32. Mehrabian A (1996) Manual for the balanced emotional empathy scale (BEES). (Available from Albert Mehrabian, 1130 Alta Mesa Road, Monterey, CA, USA 93940)
33. Barrett-Lennard GT (2015) The relationship inventory: A complete resource and guide. John Wiley & Sons Inc., Hoboken
34. Melzack R (1975) The McGill pain questionnaire: major properties and scoring methods. Pain 1(3):277–299
35. Hawker GA, Mian S, Kendzerska T, French M (2011) Measures of adult pain: visual analog scale for pain (vas pain), numeric rating scale for pain (nrs pain), mcgill pain questionnaire (mpq), short-form mcgill pain questionnaire (sf-mpq), chronic pain grade scale (cpgs), short form-36 bodily pain scale (sf-36 bps), and measure of intermittent and constant osteoarthritis pain (icoap). Arthritis Care Res 63(S11):S240–S252
36. Eisenberg N, Fabes RA (1990) Empathy: conceptualization, measurement, and relation to prosocial behavior. Motiv Emot 14(2): 131–149
37. Wool MS, Mor V (2005) A multidimensional model for understanding cancer pain. Cancer Investig 23(8):727–734
38. Miaskowski C, Kragness L, Dibble S, Wallhagen M (1997) Differences in mood states, health status, and caregiver strain between family caregivers of oncology outpatients with and without cancer-related pain. J Pain Symptom Manag 13(3):138–147
39. Schulz R, Hebert RS, Dew MA, Brown SL, Scheier MF, Beach SR et al (2007) Patient suffering and caregiver compassion: new opportunities for research, practice, and policy. Gerontologist 47(1):4–13
40. Zaza C, Baine N (2002) Cancer pain and psychosocial factors: a critical review of the literature. J Pain Symptom Manage 24(5): 526–542
41. Keefe FJ, Rumble ME, Scipio CD, Giordano LA, Perri LM (2004) Psychological aspects of persistent pain: current state of the science. J Pain 5(4):195–211
42. Hodges LJ, Humphris GM, Macfarlane G (2005) A meta-analytic investigation of the relationship between the psychological distress of cancer patients and their carers. Soc Sci Med 60(1):1–12
43. Harding G, Campbell J, Parsons S, Rahman A, Underwood M (2010) British pain clinic practitioners' recognition and use of the bio-psychosocial pain management model for patients when physical interventions are ineffective or inappropriate: results of a qualitative study. BMC Musculoskelet Disord 11(1):51
44. Klimecki OM, Leiberg S, Lamm C, Singer T (2012) Functional neural plasticity and associated changes in positive affect after compassion training. Cereb Cortex 23(7):1552–1561
45. Klimecki OM, Leiberg S, Ricard M, Singer T (2013) Differential pattern of functional brain plasticity after compassion and empathy training. Soc Cogn Affect Neurosci 9(6):873–879